# The Halliwick Concept

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# Chapter 3
# The Halliwick Concept

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## OVERVIEW AND OBJECTIVES

This chapter will provide the theoretical basis of the Halliwick Concept in relationship with its practical applicability. The text will cover explanations of two systems: the Ten-Point-Programme and of Water Specific Therapy. Both Halliwick systems will be related to the International Classification of Functioning, Disability and Health (ICF). Equilibrium and core stability are the main issues in Halliwick, therefore applications in an obstacle course and in core stabilization exercises will be suggested.

After reading the chapter, the reader will be able to

- Relate Halliwick to ICF goals
- Gain an understanding of the Ten-Point-Program
- Understand Water Specific Therapy
- Understand the principle of Halliwick applied in core stabilization
- Explain the use of Halliwick in using an obstacle course
- Read an overview of recent Halliwick research
- Begin understanding the proper modes for assessment in water

## HISTORICAL OVERVIEW

The Halliwick Concept was founded by James McMillan MBE (1913-1994). In 1950 he had the opportunity to organize an event for pupils of the "Halliwick School for Crippled Girls" in Southgate, London. At that time he was a voluntary swim coach at the local swimming club. His basic idea was to integrate the children of the Halliwick School with the local community.

McMillan started Halliwick with the idea to integrate the girls of the Halliwick School with the local population. Quickly, some of the girls learned to be independent in the pool and gained the ability to swim. This was the start of swimming clubs (the first one was the Halliwick Penguin Swimming Club in 1951) and the organization of these clubs in an association (Association of Swimming Therapy –AST-, United Kingdom 1952). The goal was to provide swimming possibilities for people with disabilities and to apply those swimming skills in a swimming competition, in swimming galas and in high-low (a combination between water polo and basketball). Currently the English Halliwick AST has 106 member clubs and similar clubs

exist in Denmark. In other countries like the Netherlands, Sweden and Germany, Halliwick is integrated in swimming clubs of Associations of Sports for People with Special Needs or clubs of the Life Saving Association.

By trial and error, McMillan, his wife and staff found a way to achieve independent movement in water, preceded by the acquisition of stable posture. The process of achieving a stable posture followed by independent movement in the water has become known as the Ten-Point-Program. In 1974 McMillan was asked by Dr W. Zinn, the medical director of the Bad Ragaz Medical Centre, to direct a project group on aquatic therapy. One of the aims was to develop an individual therapeutic approach for adults with orthopaedic, rheumatologic and neurological problems, based on the Ten-Point-Program. This resulted in expansion of the Ten-Point-Program called Water Specific Therapy (WST). McMillan wrote briefly about WST.[1,2] The first book publication however was not until 1995 by Gamper.[3]

Currently the Halliwick Foundation (HF) is responsible for the quality of the Halliwick Concept, holding the trademark of Halliwick®. Connected to the HF are the International Halliwick Association which is focused on swimming and establishing Halliwick swimming clubs, and the International Halliwick Therapy Network focused on the therapeutic applications of the Ten-Point-Program and WST. The history of the development in the UK (1949 – 1970) can be found at http://www.halliwickpenguins.org/html/history.html

## INTRODUCTION

Halliwick as a concept was originally developed to teach clients with a physical disability to swim and to make them independent in water. Independence is an important prerequisite for participation in therapeutic, vocational or recreational activities either individually or in a group. The willingness to lose balance and the ability to regain it are core elements of this independence. A Ten-Point-Program is used to reach these goals. The Halliwick Concept has been extended to include Water Specific Therapy (WST). Water Specific Therapy is focused on treating impairments of body functions or body structure. Halliwick technique uses a problem solving approach. Possibilities and constraints of the client are sequentially analysed in order to use a systematic intervention (Ten-Point-Programme and/or WST) to help the client increase function and independence. The fluid / mechanical properties of water are the basis for the intervention techniques.

For example:

- moving water provides impedance; therefore the client will move or lose balance slowly with time to react
- buoyancy forces counteract gravity forces and create rotational torques (metacentric effects). These torque forces can be used to increase load on connective tissue.
- buoyancy provides an easy way to change position, which influences the vestibular system as in sensory integration.

Halliwick is active and mostly dynamic in order to facilitate movement and sensory input. Halliwick also has a static component, involving selective activation of muscles and stabilization of specific joints. Halliwick can be used to address objectives at all components of the International Classification of Functioning, Disability and Health.[4] The Halliwick Concept has vast applications in aquatic therapy. In musculoskeletal, neurological and pediatric rehabilitation, clients can experience early mobility. The buoyancy of water supports the abilities of the

trunk in a mobilizing and stabilizing way. In this sense Halliwick is a constraint-induced movement therapy without the disadvantages that gravity-loading places upon the body.

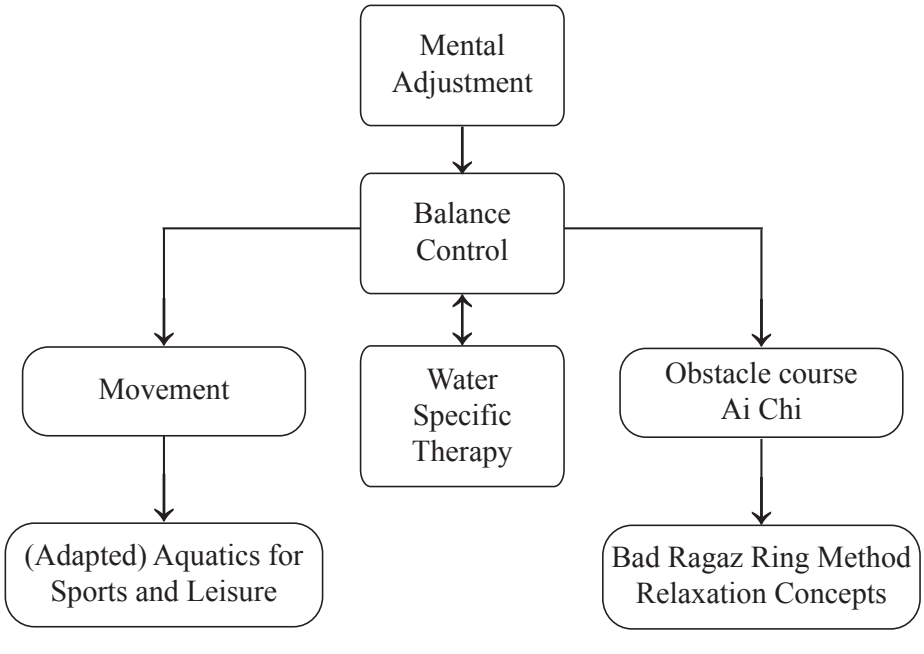
Many activities can be repeated and varied and clients can learn balance strategies which have carry-over effects to dry land.[5,6,7] Halliwick technique also enables a graded activity program with low mechanical impact and increasing physiological demand. For example, patients with chronic low back pain can increase their functional capacity in a gravity-reduced environment. Halliwick has been focused traditionally on postural control, as a basis for adequate swimming performance. This postural control can be translated as "core stabilization". Indeed many exercises that have been developed for WST can be seen currently in Pilates.

In this chapter, the Ten-Point-Program and WST will be combined to provide a coherent aquatic therapy approach based on the Halliwick Concept, linked to the International Classification of Functioning, Disability and Health (ICF). At present, Halliwick has worldwide recognition as an approach that has therapeutic, vocational, recreational, competitive properties and that also can be combined with other concepts in aquatic therapy. (Table 3-1).

## HALLIWICK AND ICF

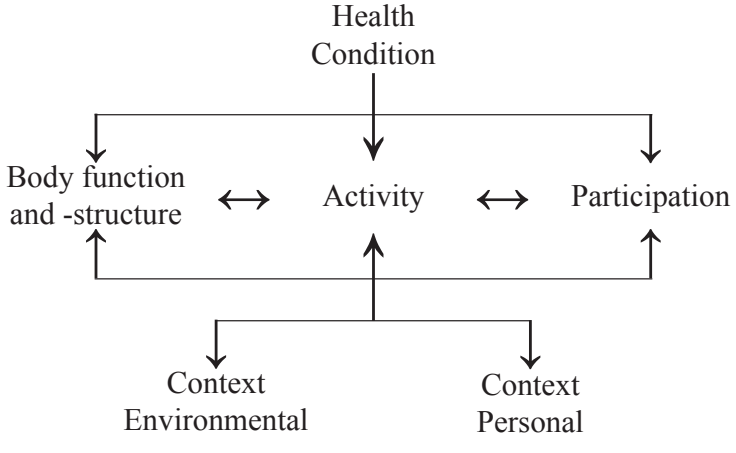
The Halliwick Concept provides various treatment applications, from stabilizing a knee joint to competitive swimming. A way to give structure to these possibilities is to use the International Classification of Functioning, Disability and Health,[4] (Table 3-2). ICF information can be found at http://www.who.int/classifications/icf/en/. The Halliwick aims and objectives for any client

**Table 3-1.** Halliwick and related concepts



should be related to particular domains. A strict difference between the Ten-Point-Program and WST cannot be given. For example, therapy at the level of *body function* might use an activity as "maintaining a body position" and therapy at the level of *activity* might be used to change a muscle tone function (Table 3-3). Maintaining e.g. a squat position could be used to influence muscle tone. Therefore from a therapeutic point of view, both systems in Halliwick are complementary.

**Table 3-2.** ICF (WHO 2001)




***General framework***

McMillan observed that lack of postural stability made his swimmers insecure. The Ten-Point-Program sequence reflects this observation. Security means the unconscious knowledge that every inhalation will be in air, and not under water by accident. This means proper breath control, but also proper head and trunk control in order to have the mouth and/or the nose above water at the right time. This postural control depends on the physical properties of the environment, in this case, fluid mechanics. Postural control also precedes movement control. This concept is evident not only in swimming but also in walking and balance activities like Ai Chi. More in-depth descriptions of the Halliwick framework, basis for the motor relearning properties, can be found in previous publications.[2,8,9]

The therapist should not be constrained to dogmatically follow the sequence of the Ten-Point-Programme, it rather is a guideline. Points that come later in the programme can sometimes be a prerequisite for earlier points and previous points may accompany later ones. As an example, Balance in Stillness (point 7) might be a prerequisite for all rotational points: going from and to a stable position.

The Ten-Point-Program has three learning stages referred to as mental adjustment (MA), balance control (BC) and movement (M).

*Mental Adjustment*

Mental adjustment is defined as the ability to respond to a different environment, situation or

**Table 3-3.** Relation of Halliwick Objectives and ICF

| Components | 10-Point-Program | Water Specific Therapy |
|---|---|---|
| b440: respiratory functions | All points, mainly MA | * |
| b710: mobility of joint functions | | * |
| b715: stability of joint functions | | * |
| b730: muscle power functions | | * |
| b735: muscle tone functions | | * |
| b740: muscle endurance functions | | * |
| b755: involuntary movement reaction functions | | * |
| b760: control of voluntary movement functions | All ten points | * |
| b770: gait pattern functions | | * |
| | | |
| d410: changing basic body position | SRC, TRC, LRC, CRC | |
| d415: maintaining a body position | MI, BIS, TG | |
| d420: transferring oneself | Entries and exits | |
| d430: lifting and carrying objects | MA, SRC, BIS | * |
| d435: moving objects with lower extremities | MA, LRC, BM and beyond | * |
| d440: fine hand use | Most of the ten points | * |
| d445: hand and arm use | Most of the ten points | * |
| d450: walking | MA, SRC | |
| d455: moving around (d4554: swimming) also bicycling, jumping, somersaulting | SP, BM, beyond point 10<br>MA, TRC | |
| d465: moving around using equipment | MI and beyond point 10 | |
| d510: washing oneself | MA | |
| d920: recreation and leisure | Beyond point 10 | |

task. The learner must be able to respond independently, automatically and appropriately to all situations in water. The independence shows as physical balance and mental desire.

*Balance Control*

Balance control is defined as the ability to maintain a position or to change a position in the water in a controlled way. The initial control may be inefficient, with large peripheral movements. The client must learn a fine degree of automatic and centralized balance control, to prevent unwanted movements and to achieve efficient postural control.

*Movement*

Movement is defined as the ability to create an effective, efficient and directed skilled activity. Table 3-4 provides the relationship between the Ten-Point-Programme, the three learning

stages as described, the dynamic or static Halliwick points and the points that are considered to be pretraining for WST.

Most Halliwick techniques are based on the use of fluid mechanics. However, it is important to understand a Halliwick specific fluid mechanic technique termed metacentric effects. Metacenter is a naval architectural term used to describe the point around which the force pendulums of gravity and buoyancy rotate. Both forces are equally important and influential and small changes in either gravity or buoyancy can cause imbalance. The asymmetric distribution of shape and density will influence the metacentric torque, and therefore equilibrium. A body in water has to make the necessary adjustments to cause the forces of gravity and buoyancy to be equal and directly opposite of each other, resulting in balance. When these forces are not equal and opposite, the body will become unstable causing the body to continually rotate, striving to reach balance

The centre of buoyancy within the human body indeed constantly moves, mainly because of the respiratory cycle. Because of the lack of fixed points (relatively or absolutely) we are in a so-called metastable equilibrium. The cranio-caudal distance between both centres of buoyancy and gravity is small but distinctive (approximately 1 cm in able-bodied adults).[10, 11, 12] Muscular activity is needed to maintain the unstable/metastable equilibrium and is both an advantage and a disadvantage. The advantage is increased focused arousal or alertness because of destabilizing effects of water. The disadvantage is over-stimulation or stress because of this same loss of balance.

If balance is lost, the client will eventually rotate to prone which is the most stable position when there are no other fixed points of stability. Of course there are many possibilities to increase stability: holding the wall, the therapist, the water (swimming / sculling movements) or increasing the base of support (this increases inertia and slows down loss of balance). On land we also have those two points (center of gravity and center of buoyancy) and the same principle generally applies. However because gravity is approximately 800 times larger than buoyancy, we do not notice these effects. With a greater than 800 times increase of buoyancy when we go into the water, both forces become more or less equally important. This means that a small change in either of the two forces will create changes in balance that are much more consequential in water than on land, especially since normally the centres of gravity and buoyancy are not in alignment and the centre of buoyancy is not always above the centre of gravity. A small change in the alignment of these two forces may create a force (apart from blowing

**Table 3-4.** Ten Points: Dividing into Learning Stage, Activity and Pretraining

| 10 Points | Learning stage | Activity | Pretraining |
|---|---|---|---|
| Mental Adjustment | Mental Adjustment | Dynamic | Preparation for WST |
| Sagittal RC | Balance Control | | |
| Transversal RC | | | |
| Longitudinal RC | | | |
| Combined RC | | | |
| Upthrust / MI | | | |
| Balance in Stillness | | Static | |
| Turbulent Gliding | | | |
| Simple Progression | | Dynamic | |
| Basic Movement | Movement | | |

out or inhaling) that may lift a part of the body out of the water when immersed or immerse a part of the non-immersed body part . This can be done intentionally by the therapist or by the patient, (see several figures.)

In the WST part of Halliwick, metacentric effects are frequently used. For example, the therapist might ask for a movement that creates a reactive closed kinetic chain stabilization of joints. These exercises were developed in Bad Ragaz in the 1970's, partly based on the theory of Functional Kinetics, a Swiss concept. Many exercises of Pilates look like the exercises from Functional Kinetics and Halliwick.

*Disengagement*

Disengagement means that the therapist withdraws manual and visual support. At the end of every disengagement process, the client should be independent and skilful in that particular activity. Disengagement therefore, is an ongoing process in all of the ten points. Reduction of manual (and visual) support means that the balance difficulty of a particular activity is constantly challenged in relation to the capabilities and skill of the client. Challenging the performance of an activity not only means that a given activity becomes more difficult, but also that the activity can be varied. This can also be done with using other principles than reducing supports. See Table 3-5 for suggestions.

Disengagement principles are the tools that the therapist uses to vary the challenge. This is the basis of motor learning. By using principles of disengagement, the client improves his/her skill. (Table 3-6)

**Table 3-5.** Possibilities to Vary and to Progress

| **Variable of an exercise** | **Easy** | **Variation or more difficult** |
|---|---|---|
| Water depth | Around Th11 | More deep or more shallow |
| Basis of support (feet) | Wide | Unipedal |
| Support: poolside, therapist | Yes | No |
| Attention | Focus on balance | Focus on environment |
| Visual control | With | Without (even eyes closed) |
| Kind of support | Full foot support | Partial foot support |
| Multiple tasks | Without | With |
| Disturbance: waves, turbulence, metacentric effects | Without | With |
| Velocity, acceleration | Low | High |
| Use of hands | With "swim" movements | Without "swim" movements |
| Use of arms | Arms wide (large radius / much inertia) | Arms close to the body |
| Direction, symmetry | Without rotational movements | With rotational movements |
| Rhythm | Steady | Changing |
| Repetitions | Few | Many |
| Range of Motion | Small | Large |
| Leverage and frontal plane | Short and small | Long and large |

**Table 3-6.** Characteristics of the execution of movements that show the amount of control in a skill

| Novel skill | Controlled skill |
|---|---|
| Variable execution | Consistent execution |
| Less precise | Precise |
| Low speed | High speed |
| Much cocontraction | Smooth |
| Visual control needed | No visual control |
| Visible postural adaptations | Invisible postural adaptations |
| Less flexibility in performance | Flexibility |

***Function Level***

Specific applications of Halliwick at the ICF function level across several systems. The most pertinent applications will be reviewed, but understand that many additional applications relevant to the ICF function levels exist.

*Respiratory Functions*

Mastering breath control, especially exhalation, is of utmost importance. The client is instructed to "blow" whenever his or her mouth gets close to the water, so "blowing" becomes automatic when the mouth touches water. This prevents swallowing and choking. It also facilitates head control, as the head comes forward when one blows, reducing the risk of a loss of balance. The therapist may cue manually by bringing the head into good alignment and/or the cheeks into good position (Figure 3-1). Breath control can be regarded as a part of oro-facial therapy and an extension of techniques from speech therapy. Blowing, humming, singing and talking are variations of breath control. Rhythm is used to facilitate movement. Speed of singing or talking (rhymes) can be adapted to change velocity of movement in water.

Breath, head and trunk control must be considered simultaneously (see Activity and Participation level: Introduction and Mental Adjustment)

*Mobility of Joint Functions*

Originally, Halliwick was not designed as a mobilization concept,. But the large rotational movements that occur stress connective tissues (both the ground substance and the collagenous fibres) within their normal anatomical orientation This may decrease the tissue stiffness and enhance realignment of new collagenous fibers.

*Stability of Joint Functions*

Classically, the Ten-Point-Program starts with supports at the upper extremities. This has led to the development of a series of exercises to enhance stability around joints, especially the scapulo-thoracic (Figure 3-3). In many stabilizing exercises, the point of fixation and the point of mobility are reversed. This gives the possibility to stabilize in another way than on land and can change the patient's awareness of his/her body (Figures 3-2, 3-4, 3-5, 3-6, 3-7, 3-8)

**Figure 3-1. Respiration with cheek control in Mental Adjustment**

**Figure 3-2. Mobilizing and stabilizing exercise in Combined Rotation Control**

*Muscle Power Functions*

Almost all Halliwick activities require trunk stabilization activity. This is related to the understanding that during swimming, the trunk must be stable enough to permit arms and legs to effectively propel. In the development phase of WST, a series of special exercises (based on the Ten-Point rotations and used during "Balance in Stillness") were created that specifically address core stability (Figures 3-4, 3-5, 3-7). Halliwick techniques are used intentionally and reactively, using counterforce activity when working metacentrically or with turbulence. This also allows the incorporation of eccentric muscle activity in rhythmic stabilization-type exercises. When patients perform Halliwick activities, abdominal activity is obvious. A recent study in Korea[5] also showed increased dry land torque of the back extensors after Halliwick transversal rotational exercises.

*Muscle Tone Functions*

The creation of large rotational movements facilitated by buoyancy and homeostatic pressure effects in a gentle and continuous way helps to normalize tone (Figures 3-9, 3-10). This can be regarded as a prerequisite to facilitate the flow of normalized kinaesthetic information to the central nervous system, where it becomes the basis of plastic neural adaptation. The effects on patients with tone dysregulation were the first observation in 1950. The first group of swimmers showed better symmetry, better selective extension and better oro-facial motor functioning on land.

*Muscle Endurance Functions*

Muscle endurance can be addressed through prolonged activities (high repetitions with low resistance) like swimming or walking. Since most of the Halliwick exercises do not really need high power, all activities can be repeated quite easily and muscle endurance can therefore be trained over the whole range of the Ten-Point-Program.

**Figure 3-3.(Core) stabilizing exercise in Combined Rotation Control**

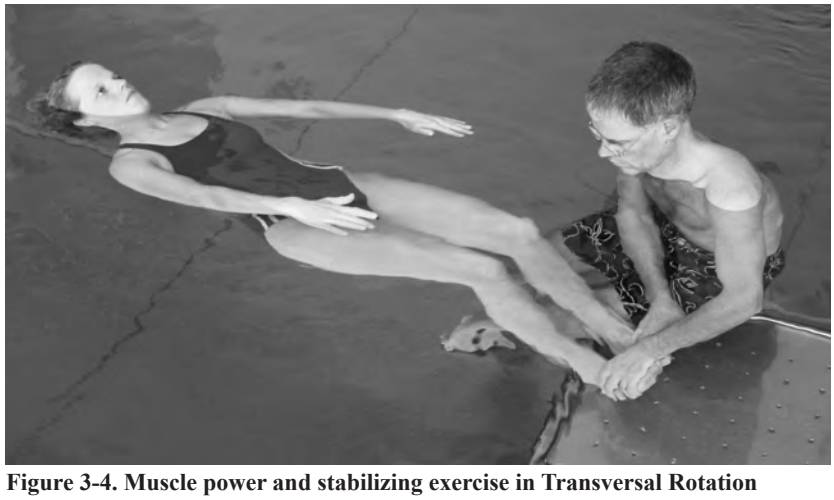


**Figure 3-4. Muscle power and stabilizing exercise in Transversal Rotation Control**

*Involuntary Movement Reaction Functions*

The hydrostatic and hydrodynamic properties of the water (b create an inherent instability that may minimize the need for muscle power to facilitate a movement and slow the speed of positional changes. These properties are the prerequisites for intervention options to address equilibrium reactions, righting reactions and supporting reactions (Figures 3-5, 3-8, 3-9, 3-11). Visual, vestibular and proprioceptive righting reactions can be exercised during all rotational points.

**Figure 3-5. Involuntary movement reaction function exercise with core stability elements in different rotations**

*Control of Voluntary Movement Functions*

In ICF, this is a general term for coordination of any movement, including left-right coordination or eye-hand coordination. During all exercises and activities of both WST and the Ten Points, patients need control of voluntary movements.

*Gait Pattern Functions*

Walking or running patterns and their impairments like asymmetric gait belong to this item. Walking in water differs from walking on land. Kinetic and kinematic parameters are different than land-based walking.[13] In the past this difference led to assumptions that shallow water walking cannot be used to prepare for walking on land. Clinical research has shown however, that patients are able to transfer elements of their gait pattern and increase land walking skills.[14]

***Activity Level***

While function refers to interventions directed at the system level, the activity level refers to interventions directed at the level of the whole person.

*Mental Adjustment*

When starting any program in a pool, clients should not be afraid of water. This in particular is important in the Halliwick Concept, being originally a method to teach clients to swim. Also when focusing on objectives at function level (ICF), clients should be able to participate without insecurity. Mental adjustment, therefore, might have to precede therapeutic activities of any type in which clients are supposed to move freely in a pool. Mental adjustment is achieved through posture and movement, but also the experience, spatial awareness, and awareness of the effects of the altered mechanics on movement and posture. Teaching objectives include the experiences that water:

**Figure 3-6. Gait function stabilizing exercise in Balance in Stillness**

- is wet
- enters "holes" such as the mouth, eyes, ears, nose
- provides instability (buoyancy, metacentric effects)
- is heavy (drag, impedance)
- keeps moving (turbulence)

The purpose of Mental Adjustment is to enable the client to react automatically, independently and appropriately during upright activities in water (Figures 3-6, 3-7, 3-8, 3-11, 3-12, 3-13). Acquisition of breath control is a key issue. (see function level: respiratory functions, figure 3-1). To produce a desired movement in the water, one must be comfortable in an altered mechanical environment. This requires learning adaptations for dealing with buoyancy, hydrostatic pressure, hydrodynamic flow, and turbulence.

Mental adjustment addresses this adaptation. The client experiences and becomes comfortable with altered balance, helped by a therapist who introduces a variety of vertical movement patterns. The client experiences mechanical stimuli resulting from buoyancy and impedance. Feedback to the client is focused on instructions to use the head to steer the trunk and the lower extremities. Breath, head and trunk control must be considered simultaneously. The therapist must use support properly to ensure control in all three areas. Support should provide stability without providing too much comfort. The client should be out of balance enough to be challenged, but not enough to lose balance and become overly stressed (increased arousal).

*Changing Body Positions*

In the Halliwick Concept, this domain is made operational through rotational activities.

**Sagittal Rotation Control**

Sagittal Rotations are movements around sagittal axes. These movements include lateral flexion of every part of the spine and abduction and adduction of the extremities. Sagittal rotation control is required for movements in place, as well as moving activities such as walking sideways and changing direction. Sagittal rotations are most functional in upright positions (Figures

**Figure 3-7. Longitudinal Rotation Control: core stability and facilitation of involuntary movement reaction function**

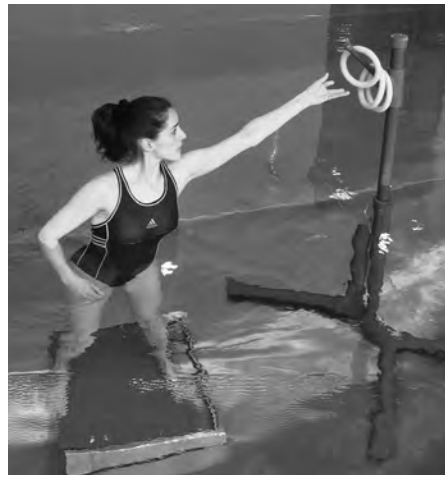


**Figure 3-8. Fine hand use and arm use in Balance in Stillness**

3-5, 3-15), but also are seen in supine position as lateral flexion of the trunk in seaweeding activities, or in swimming a crawl stroke (in the latter as a compensation of insufficient longitudinal rotation control).

Unlike the other rotations, sagittal rotation is usually performed through a small range of motion. The main focus is on shifting the centre of gravity or shifting weight in the frontal plane. This can be done in any functional position, such as standing or sitting and normally includes a reaching action of an arm, a hand activity and looking at that hand.

Sagittal rotation can be used therapeutically to mobilize or stabilize the spine with lateral flexion movements, to lengthen the trunk, to facilitate optical righting reactions and equilibrium reactions (reaching out), to stimulate abduction of arms or legs; or to shift weight from left to right.

**Transversal Rotation Control**

Transversal rotations are movements around *any* transverse axis in the body. Transversal Rotational Control (TRC) can start with small movements, such as head anteroposition when blowing out, but become more functional when the client starts shifting the centre of gravity in a forward-backward direction, usually combined with reaching and a hand activity. Range of motion can be enlarged by adding longitudinal rotation to increase the reaching distance. (Figure 3-8). This is also a principle from disengagement. (See Table 3-5)

Another application of TRC is sitting down or squatting into a "chair position" and reverse. In Halliwick the client is cued to "sit in your chair with your hands on the table." Standing up again is the second phase of this movement. Depending on water depth, during this activity the critical anatomical point of the eleventh thoracic vertebrae (T11) is immersed and comes above water again. In Halliwick, T11 is used as a marker for the change from gravity dominant to buoyancy dominant equilibrium, with resulting effects on leg/foot control or head control, respectively. The chair position is the starting point for the important positional change from upright to supine and reverse. Supine is favoured for safety reasons, as the nose and mouth are

**Figure 3-9. Supportive functions of the arms and hands in Combined Rotation Control**

**Figure 3-10. Combined Rotation Control**

**Figure 3-11. Obstacle course, training involuntary movement reactions**

free of the water. Later, the prone position (a very stable position) is introduced as a challenge. Rolling out of prone is quite difficult.

In the supine position, the body behaves like a canoe. The main and fastest rotation takes place around the longitudinal axis. Loss of balance/midline symmetry, or even the feeling of loss of balance, may result in massive (pathological) equilibrium reactions, combined with increased extension and/or flexion of the spine. The reasons are obvious: fixed points between feet and floor have disappeared, normal visual input has changed, communication is more difficult (ears under water), fear of swallowing water arises, and the body rotates quickly around the longitudinal axis. Therefore, transversal rotation must be taught slowly, gradually increasing the client's range of motion toward supine in small, manageable stages. It is equally important to teach the client how to stand up independently, as inability to achieve a stable vertical position is a major source of fear.

Cues for transverse rotation are: head forward, reach forward with the arms, catch an object above the water, blow out, tuck in head / hips/knees and try to sit on the floor of the pool.

In later stages the client should be able to stand up independently from prone and turn from prone to supine vice versa around a transverse axis. However, the pool side can be used as well to include activities as reaching, gripping and releasing the bar, pushing off from the side. Forward and backward somersaults would be the ultimate transversal rotational controls.

Therapeutically, transverse rotation is a kind of selective extension. All elements of this selective extension can be used therapeutically: positioning of the head on the trunk, alignment of the spine, extension of the dorsal spine, achieving appropriate scapular depression, controlling pelvic tilt, eccentric contraction of the abdominals, inhibition of associated reactions, and developing symmetry of movement (Figures 3-1, 3-4, 3-11).

**Longitudinal Rotation Control**

Longitudinal Rotation takes place around the longitudinal axis or midline of the body. This rotation is most important in supine. Preparations can begin in upright positions like standing and passing an object in a circle of clients (shift the centre of gravity) or when turning around while walking. The first movements in a horizontal plane are symmetrical with a gradually decreasing radius (arms at the body, legs together). Support is provided preferably at the centre of balance (around the second sacral vertebra). Balance control is focussed on (contra) rotational head activities of the client. Next, the client actively rotates by using the head in rotation and crossing the midline of the body with the arm and leg. Ultimately, the goal is to roll 360°, back to the supine position. Basically, this is a safety skill, as supine position is considered a safe position for breathing.

Each of these skills is taught separately, then all are executed together to accomplish the full rotational pattern. This analytical approach is necessary, because longitudinal rotation requires maximal disassociation between head, shoulder girdle and pelvic girdle, during a fast movement that also involves a breath skill.

The therapeutic application of longitudinal rotation is facilitation of the head-to-trunk righting reactions. The abdominals, which are active during this rotation, are important rotators; increasing their selective and stabilizing function is one of the major therapeutic objectives in longitudinal rotation, important for both swimming and walking. This rotation may also be used to reduce muscular tone of spastic trunk muscles, such as the quadratus lumborum and the latissimus dorsi muscles.

**Figure 3-12. Moving around using equipment**

**Figure 3-13. Lifting and carrying objects plus hand and arm use while negotiating obstacles**

### Combined Rotation Control

Combined rotation control includes both *transversal* and *longitudinal* rotations during a forward roll, and *sagittal* and *longitudinal* rotations during a sideways roll. (Figure 3-10) Combined rotation might seem more difficult to accomplish than the individual rotation patterns, but actually is rather easy as it combines those previously mastered patterns. The goal is to roll out of trouble when one loses balance and end in a supine position.

In fact, all rotations in water have a combined character. Bodies move three-dimensionally requiring control in three dimensions. (Figures 3-2, 3-3, 3-5, 3-8, 3-9, 3-14) Moreover, clients with impairments usually have asymmetric distributions of shape and/or density (specific gravity). This increases the need to teach combined rotation control by putting separate rotations together.

The most important therapeutic use of combined rotation is teaching clients how to fall and stand up again. Water allows one to "dare to make errors," losing balance without the risk of pain or injury. Begin in deep water and work progressively to shallow.

*Maintaining Basic Body Positions*

Body positions that can be maintained include supine or prone lying, squatting, sitting, kneeling, standing or gliding and applied in a variety of techniques outlined below.

### Upthrust or Mental Inversion

Understanding the concept of upthrust - that one cannot sink, but always will rise to the surface again – is fundamental to comfort and safety in the water. Many people are afraid to submerge, or of being unable inhale air when they need to do so. With simple activities, a client can learn that the body will generally always float up to the top. When a client understands and can dem-

**Figure 3-14. Hand and arm use, combined with breath control**

onstrate this concept, he or she is considered to be waterfree. The client should learn to wait in different positions while floating up to the surface after a deliberate submersion. This can be done in any of the aforementioned positions.

This point concludes the first part of the Ten-Point-Program that is focused on mental adjustment and rotational control. While this portion has important therapeutic potentials in itself, it is the foundation (pretraining) for the more advanced work of WST.

**Balance in Stillness**

Balance in stillness is the most static point in the Ten Point Program, the point at which the client begins to perfect rotational control. The focus is on posture, equilibrium and stability in the mentioned positions. The client must react with motor activity of axial structures such as head and trunk. Compensations such as hand movements, widened base of support or muscle stiffening are not allowed. The therapist disturbs balance with manual turbulence around the swimmer, asking for metacentric effects or using a wave during step-stop activities. Because this is preparation for swimming, positions progress from upright to supine. In the supine position, the client might be supported, a departure from the disengagement the therapist maintains when the client is in other positions. The therapist uses counter-rotational muscular activation in any of the previous rotational controls to achieve stability in this point.

Balance in Stillness can be used therapeutically when stability (co-contraction, isometric activity) is needed. The most important regions to work on are the shoulder girdle, the trunk, the pelvic girdle and the hip region (Figures 3-2 to 3-9).

**Turbulent Gliding**

Turbulent Gliding is a “dynamic” follow up to Balance in Stillness. The client maintains static balance while being moved. The client is supine and controls all rotations (good alignment of the spine, hips extended, trunk symmetrical, with no lateral flexion or abductions). The therapist tows the client in a wake of turbulence, which challenges balance.

Therapeutic options are restricted and mainly focussed on facilitation of dynamic trunk control during this specific activity.

**Figure 3-15. React to unexpected movements: stumble sideways**

*Transferring Oneself*

The Halliwick Concept uses also variety of entries and exits, which is especially important when the client's objectives are to participate independently in recreational aquatic activities. A full description falls outside the scope of this chapter. Further information on these techniques can be found in the Additional Resources listed at the end of the chapter.

*Lifting and Carrying Objects*

Lifting and carrying skills are used in many exercises and activities. When the patient needs to use the body function elements introduced in WST in a functional way, task specific activities are developed. Originally this was done when using games in the Ten-Point-Program. Later obstacle course like activities in which lifting and carrying objects are integrated were developed. An example is shown in Figures 3-8, 3-11,3-13, 3-15, 3-16. A specific way in which "objects" are carried is during group activities when patients are helping one another, such as the jumping activity. (The client lifts both feet to jump as a frog, supported by another client.)

*Moving Objects with Lower Extremities*

ICF specifically mentions kicking and pushing. Apart from the leg kick in various swimming strokes, legs are used in this way during bicycle games, push offs from the side for prone or supine glides and kicking or pushing objects on the bottom of the pool (Figure 3-12).

*Fine Hand Use*

Fine hand use is incorporated into activities such as working with plastic flutes when training breath control. Passing objects in Longitudinal Rotation Control, picking up objects from the pool during Mental Inversion or manipulating rings or a tray (Figures 3-8, 3-13) are also examples of fine hand use.

**Figure 3-16. Hurdles of different heights cue various step characteristics**

*Hand and Arm Use*

Hand and arm work is used mainly in Mental Adjustment where manual supports are provided. Classically this would be the point to address the use of hands and arms during pushing, pulling, reaching, lifting of water or splashing. (Figures 3-3, 3-8, 3-9, 3-13, 3-14). Rotational control generally takes place in a "hands-free" fashion. After these points, when pretraining has been achieved, use of hands and arms become important again when clients start to use equipment in a kind of task-type training approach.

*Walking*

Relative to the ICF, walking is addressed only over relatively short distances. Water specific walking utilizes fluid mechanics. Three examples of using fluid mechanics during walking are:

1. using buoyancy: ask clients to lope (walk on the moon) and to softly catch weight when landing, a difficult task on dry land.
2. using the inertia of water (waves), ask clients to walk, then stop without loss of balance when the wave hits the body
3. using drag: ask clients to walk like a soldier with extended legs and resist the reaction forces on the other leg, .i.e. the hip of the stance leg must be held in extension.

Different surfaces or obstacles can be included in formal or informal obstacle courses. See the section of falls prevention for possibilities of the formal aquatic obstacle course.

Aquatic therapy allows clinicians to use various depths in order to control weight-bearing and to vary the ratio of lower extremity activity to head activity. Many clients automatically choose to walk in depths around their sternum. This obviously provides the best combination of gravity support and buoyancy support. When changing depth, focus can be given to more weight-bearing or to more flotation effects with consequent head reactions.

*Moving Around*

This topic of the ICF includes all swimming techniques, but also jumping and bicycling as is

done in Mental Adjustment. Moving around also means that the client learns the three dimensional properties of water while somersaulting, cart wheeling or other movements. In the Ten-Point-Program, two points belong to moving around.

**Simple Progression**

When the client can control the position during Turbulent Gliding, the therapist introduces propulsion. Initially this involves a symmetrical motion of the hands, under water and close to the pelvis. Though the movement is not particularly effective for propulsion, the goal is to introduce peripheral movements while maintaining adequate control of the trunk and head. Therapeutic possibilities are similar to those of Turbulent Gliding. The difference is that the client now has to control both central stability and propelling movements. This double task is more difficult than the previous skill.

**Basic Halliwick Movement**

The basic Halliwick swimming stroke uses only the arms for propulsion. Features are: symmetry, range of motion for the recovery movement from 0° - 120° abduction, and only hands are taken out during the recovery. These symmetrical movements with the arms are easier to control than alternating arm-crawl movements (affecting midline symmetry) or leg movements (affecting pelvic stability). This is the first attempt to really move efficiently and effectively. At this point, the swimming stroke may have to be adapted to the individual abilities of the client. Development of swimming strokes will include alternating strokes, side lying positions, prone positions and use of fins and other equipment.

Large arm movements influence trunk and head control more than Simple Progression does. Therapeutically, swimming can be used to work on local and general aerobic endurance.

*Moving Around Using Equipment*

The Halliwick Ten-Point-Program classically does not use any kind of equipment that offers additional stability, like neck collars or arm wings. For the more severely affected clients however, a flotation device might be the only way to move independently. Being able to use custom made equipment, therefore, is a skill that can be included in Halliwick. Floating equipment like noodles or kickboards can be used to increase the difficulty of a balancing activity when the client sits or stands on it. This is consistent with the use of metacentric effects and fits with the ideas of WST.

Also, other kinds of aquatic equipment like fins, masks, snorkels, scuba or a wetbelt can be a functional extension of balancing skills in or under water and is related to the participation level of the ICF ( aquatic fitness clubs, recreation, vacation).

*Washing Oneself*

Mental adjustment to water also includes client's allowance to have water over the head; hair and face get wet and water enters the ears, eyes, nose, and mouth. Water is wet.

Although these activities belong to the general adjustment to water, it has been placed separately in order to keep the relationship with the ICF.

***Participation Level***

See also the historical overview. Halliwick was designed as a swimming concept to enable clients to meet other people during recreational activities or sports. This needs proper swimming biomechanics.

After clients have acquired the Basic Movement, other strokes may be introduced and might have to be adapted to the needs of the client. This means that knowledge of the biomechanics of regular strokes and of health problems (ICF) must be combined to find the optimum in terms of efficiency and efficacy. The Halliwick Concept would follow a mix of the sequence:

- Supine to prone position
- Arms to legs to arms /legs combined
- Symmetrical to alternating movements

A considerable number of clients who are treated with Halliwick principles are not interested in going to a swimming club. They choose to continue water exercises in whatever organisation is responsible in their particular area, for example an association for Parkinson patients. For these clients, Ai Chi and Ai Chi Ne are a great continuation of the previously learned Halliwick skills. A closer view on the relation will be given in the section on falls prevention.

## HALLIWICK APPLICATIONS

Although Halliwick was originally developed as a way to achieve independence through swimming activity, its essential elements have proved to be used training for a variety of other skills.

***Fall Prevention: Ai Chi and Obstacle Course***

Halliwick is focused on learning how to balance in water. This is a prerequisite for both swimming and walking. The postural control required for walking needs a sequence that is slightly different from the normal Ten-Point-Programme. The sequence would be:

- Mental adjustment, especially breath control. When losing balance in water, the client must be able to react quickly with an expiration and should control breath for about 5 seconds. This is the time usually needed to stand up in a controlled way.
- Mental Inversion, or knowing that one will float up again. There will be a short period in which the feet are off the floor. During this period the client must use head balance to come upright and place the feet on the floor.
- Transversal and Combined Rotation Control. The client can fall in any direction (even “as a tree”), and roll to the back with the face out of the water. The client breaths, thinks and stands up again.
- Sagittal Rotation Control. The client must learn to reach sideways and know the limits of reaching without losing balance. Subsequently other directions are included.
- Later, Longitudinal Rotation Control and balance in Stillness will be used to “polish” trunk control.

Balance consists of a mix of intentional task oriented activities and non-intentional balance strategies (3-7) Balance strategies are non-intentional strategies, which accompany intentional

activities that require postural adaptations.[15] These postural adaptations (non-intentional strategies) can have either predictive purposes or corrective/reactive purposes. Reactive strategies can be trained safely in a pool. When clients react too late, they have more time to respond (some 14 times when one refers to the differences in kinematic viscosity between water and air) and less fear to make large movements.[16]

A preparation for Halliwick at ICF activity level would be WST exercises at function level, like exercises to increase joint mobility of the lumbar spine or exercises to increase strength of feet dorsal flexor muscles. A logical progression would be to design exercises from open kinetic to closed kinetic chains and from reactive to active exercise. The continuation of Halliwick at ICF activity level would be to use balancing strategies functionally. Like on dry land, obstacle courses and T'ai Chi (or Ai Chi) can be used. Land obstacle courses and T'ai chi are used successfully to increase balance and to reduce fall risk.[17, 18, 19,20] The first studies of Ai Chi are in progress.

An obstacle course has been developed to train these concepts, put forward by Means.[21] A more informal "obstacle course" would be a task-type training approach with non-specific equipment to facilitate balancing activities in an enjoyable way.

*The Obstacle Course*

The ICF describes the following categories, related to fall prevention, in the chapter Mobility.

- shifting the body's centre of gravity (d 4106)
- maintaining a standing position, irrespective of surface (d 4154)
- pushing and kicking with 1 leg (d 4350 and 4351), thus standing on 1 leg
- walking (d450), like strolling, sauntering, walking forwards / backwards / sideways, subdivided in e.g.
  - walking on different surfaces (d 4502)
  - walking around obstacles (d 4503)
- running (d 4552)
- jumping (d 4553)
- moving around with equipment (d 465), e.g. walking ( carrying objects)

Some activities related to balance have quantified norm values that can be used as well in the pool as a kind of target or guideline. The Berg Balance Scale gives the following values as normal (maximal rating of 4 points):

| | |
|---|---|
| Standing with eyes closed | 10 seconds safely |
| Standing with feet together | 1 minute, feet together safely |
| Reaching forward with outstretched arm | > 25 cm confidently |
| Turning 360 degrees | in 4 seconds or less |
| Placing alternate foot on stool | complete 8 steps in 20 seconds |
| Standing with one foot in front | place foot tandem and hold 30 seconds |
| Standing on one foot | lift leg independently and hold >10 seconds |

Exercising balance should also follow the balance strategies that are described in Table 3-7. Always, intentional movements and non-intentional strategies will be used together. As an example: a contra-weight strategy accompanies a reaching movement, also using a hip strategy. Balance is lost and a forward stepping strategy is used to correct.

Balance loss in general is not expected; therefore unexpected elements should be included in a fall prevention programme as well. The easiest possibility is to have clients work in pairs,

and they have to react to each other. As an example: throwing a ball to each other: different heights, sides, angles etc. Standing on a wobble board makes that activity even more difficult.

Every exercise should progress in difficulty. There is a wide array of options: see Table 3-5. Obstacles can be used to avoid (step over) them or to walk / stand on them

**Balance Beam** (Figure 3-3, 3-13)

a. wide position, narrow position, straight, in a rectangle, combined wide and narrow positions, different depths. Possibilities:
b. walk forward, backward: small steps and going to strides, tiptoes, heels, lift knees, swing leg straight to next stance, bring heel to buttock first, increase stance time, close eyes and feel the beam, hands on head, carry an object or push a ball under water, little jumps, change direction, like a soldier, like a stork, dribble, walk on hot sand, slope up/down
c. walk sideways, without or with crossing the legs
d. stand: throw or push objects, move arms through water, look around shoulder, change base of the feet till standing on 1 leg, close eyes, feet in front or next to each other, reaching activities, pelvic movements, belly dance, Bavarian dance, Russian dance
e. walk on the floor and step over the beams: left to right, with crossing the legs, forward / backward, jump over the beams,

**Wobble Board** (Figures 3-8, 3-11, 3-15)

f. Sideways shift; skiing, samba
g. Forward / backward shift: Possibilities
    i. Small – large shifts of weight like rocking horse
    ii. Combined movements like belly dance
    iii. Expected – unexpected to facilitate corrective strategies
    iv. Different bases, to single leg stance, eyes closed, double tasks, arm movements for balance or reaching, supported / unsupported (bar, therapist)
h. Ai Chi movements

**Hurdles** (Figure 3-16)

i. Different heights and inclinations, different distances
j. Combinations with the balance beam. Possibilities:
k. Step over hurdle(s): forward, backward, sideways, legs crossing

**Table 3-7.** Balance Strategies

| Intentional activities with specific balance components | Non-intentional balance strategies | |
|---|---|---|
| | Predictive | Corrective |
| Initiation | Counter-weight | Ankle strategy |
| Weight-bearing general | | Hip strategy |
| Go to limits of reaching | | Stepping / stumble strategy |
| Unipedal stance | | |

l. Step over 2 or 3 hurdles at the same time
m. Rocking horse
n. Jumping, loping (walk like on the moon)

**Reaching pole** (Figure 3-8)

Important is to stimulate the client to reach as far as possible and find the (comfortable and safe) limits of reaching.
o. Hang rings on / pick rings off the hook. Possibilities:
p. Change distance from the pole, change the height of the pole
q. Throw
r. Change hands
s. Different stance positions
t. Combine with balance beam or wobble board

***Core stabilization***

At present, much attention is paid to core stabilisation techniques like in the Pilates concepts. Translations have been made to water already. Water Specific Therapy however, has a series of exercises that are designed to increase postural control. This was a logical continuation of the Ten Points when McMillan was asked to develop a therapy program for adult clients with neurologic, orthopaedic and rheumatologic problems. This became Water Specific Therapy (Figures 3-2 to 3-7, 3-9, 3-12)

## ASSESSMENT

Halliwick skills are assessed in several ways. An assessment of Ten-Point-Program skills has been developed by the English AST. Assessment leads to several badges, indicating a certain level of skill. This assessment system has never been subject to reliability and validity studies. More recently, Tirosh[22] has revised this assessment system. The WOTA1 and WOTA2 (Water Assessment Test Alyn) reliably assess Halliwick Ten-Point skills, with excellent test-retest co-efficients.[23] WOTA1 is a simplified version of the WOTA2, created for children who are not able to follow verbal instructions. WOTA also has been shown to be valid - having a significant correlation with the Gross Motor Function Measurement – as well as responsive and thus able to track changes over time.[23]

In development is a system to assess skills at ICF activity level. No reliability studies have been performed yet and the grading system has not been described yet as well. Both are in preparation. In table 3-8 an example is given.

## CLINICAL APPLICATIONS AND CLINICAL REASONING

***Case history: History and Present State***

A 63 year old truck-driver suffered from an apoplexia (CVA or stroke) 2 months ago. This resulted in a right sided hemiplegia with a minor dysphasia. After a short period in the acute hospital, the man was referred to the rehabilitation centre for clinical rehabilitation. The method of rehabilitation, used by all disciplines is Bobath / Neurodevelopmental Treatment.

**Table 3-8.** Halliwick Concept ICF Assessment

| | Assessment in Conjunction with the ICF | Halliwick Point | No Difficulty (3) High Quality Performance | Moderate Difficulty (2) Medium Quality | Severe Difficulty (1) Low Quality | Complete Difficulty (0) Does not Perform | Not applicable (0) Not assessed | Breath Control Included |
|---|---|---|---|---|---|---|---|---|
| Respiratory Function b440 | Mouth: bubbles (5 sec) | MA | | | | | | ■ |
| | Nose: bubbles (3 sec) | MA | | | | | | ■ |
| | Head under, blowing (5 sec) | MA | | | | | | ■ |
| | Rhythmic exhalation (with mouth, (6-9x / 1 min) | MA | | | | | | ■ |
| | Exhalation alternately (3x) through mouth and nose | MA | | | | | | ■ |
| d510 Halliwick | "water over the head" | MA | | | | | | |
| Changing a Basic Body Position d410 | Shifting CG forward/backward (25 cm) | TRC | | | | | | ■ |
| | Shifting CG left/right(25cm) | SRC | | | | | | ■ |
| | Sitting down | TRC | | | | | | ■ |
| | Standing up | TRC | | | | | | ■ |
| | Lying down | TRC | | | | | | ■ |
| | Sitting up | TRC | | | | | | |
| | Rolling over right | LRC | | | | | | |
| | Rolling over left | LRC | | | | | | |
| | Turning and glide / with SRC or TRC | CRC | | | | | | |
| Maintaining a Body Position d415 | Stand (30 sec) | BIS | | | | | | ■ |
| | Sit (40 sec) | BIS | | | | | | ■ |
| | Supine/oblique (15 sec) | BIS | | | | | | |
| | Floating up (5 sec) | MI | | | | | | |
| | Gliding supine (10 sec) | TG | | | | | | |
| | Gliding prone (5 sec) | | | | | | | |
| Moving Around, walking and Transferring Oneself d420, d450, d455 | Walking (6 m or more) | MA | | | | | | ■ |
| | Changing direction | RC | | | | | | ■ |
| | Turning 360° (< 4 sec) | LRC | | | | | | ■ |
| | Jumping (+ blowing, 5x) | MA | | | | | | |
| | Swimming (15-25 m) | BM | | | | | | |
| | Swimming prone (15-25 m) | | | | | | | |
| | Entry | | | | | | | |
| | Exit | | | | | | | |
| Use of Hands, Arms, Legs or Fine Hand Use d435, d440, d445 | Legs: pushing, kicking | | | | | | | ■ |
| | Arms: pushing, pulling | | | | | | | ■ |
| | Arms: reaching | | | | | | | ■ |
| | Hands: passing an object | | | | | | | ■ |
| Carrying Objects d430 | Transport objects | | | | | | | ■ |
| Moving Around Using Equipment d465 | Mask or goggles | | | | | | | |
| | Snorkel | | | | | | | |
| | Fins | | | | | | | |
| | Other | | | | | | | ■ |

Currently the patient is able to ambulate slowly with manual facilitation by a therapist. He needs an ankle-foot orthosis (AFO) to hold the right foot in dorsal flexion. Both physiotherapy and occupational therapy focus on posture training. There is a marked tendency to shortening the affected side of the trunk.

In daily activities he still needs a wheelchair. Transfers are independent, and so is personal care. The right hand is spastic. The arm shows some signs of recovery, although the shoulder hurts, despite wearing a sling. Before the patient had a stroke, he swam on a recreational basis.

*Treatment Plan in Water*

The physiotherapist suggested hydrotherapy to support the sensori-motor rehabilitation.

The objectives are to:

- facilitate independent head to shoulder movements, i.e. to facilitate righting reactions
- relax the right shoulder and arm in order to decrease tone and pain
- improve trunk symmetry and to train the affected abdominals (these are hypotonic)
- disassociate hip-pelvis-thorax-head activity
- reinforce sensory input and vary experience in order to enhance motor learning
- increase aerobic capacity / stamina
- improve independent ambulation
- learn to swim again
- present an enjoyable situation that distracts from dry land rehab and motivates to move.

*Considerations*

- Immersion in water prevents the mechanisms that can occur to compensate for the "normal physiological" extension against gravity
- Immersion in warm water, and added slow movements promote relaxation that can be used as a preparation for stretching (neurodynamic) techniques.
- The relative unstable position in the pool (fixed points fail) force the body to actively balance, especially around the symmetry-axis of the body
- Lack of fixed points also facilitate the use of the head during balancing activities
- The tactile input of water is a different source of feedback, compared to dry land, and is important in motor learning
- The patient will go into a sedentary lifestyle. There is a clear need for a kind of physical activity that he favors, which is swimming.

*Pool Considerations*

A pool is needed that can give space to ambulate and swim. The water depth should enable:

- The patient to swim, including a safe way to stand up (make a transversal rotation )
- The patient to ambulate in such a way that both the advantages of buoyancy (weight reduction) and gravity (working in a relatively closed kinetic walking chain) can be combined.

*Interventions*

- Relaxation (e.g. using the rhythmic initiation technique of the Bad Ragaz Ring Method) of the right arm and shoulder. The therapist gently moves the patient through the warm water

and asks for a guided active motion within the limits of pain. The flotation aids are used to enable the therapist to localize stretching and mobilization.
- The Halliwick Method can be used for all other objectives
- Adapted swimming, e.g. according to Halliwick

*Program*

Start with Relaxation and Halliwick, continue with Halliwick techniques and finally proceed to swimming. The frequency should preferably be at least twice a week to establish proper progress. Duration of a session could be 30 to 45 minutes. The patient should continue the swimming in a swimming club for people with special needs.

## RESEARCH

### *Evidence Based Practice*

The implementation of research is the effect of what currently is known as Evidence Based Practice. As for every concept in physiotherapy or aquatic therapy, the amount of patient related research of moderate to high quality, also in Halliwick still is limited. In recent years some studies on the effectiveness have been published however.

### *The Halliwick Concept: Recent Studies*

Bea Jung-Hyuk looked at the effect of hydrotherapy on improvement of balance in stroke patients.[5] In this study, 26 people with a stroke were given a hydrotherapy programme, based on Halliwick. There was no control group involved. The measurements were done with the Berg Balance Scale, with significant increases of the scores. The author concludes that hydrotherapy should be an effective treatment to improve the recovery of balance control, symmetrical posture, strength of the trunk muscle and arm reach function through the improvement of trunk stability.

The effect of hydrotherapy on balance and weight-bearing ability in people with chronic stroke was assessed by Noh Dong-Gook.[24] The purpose of this study was to compare the effect of a combination of Halliwick and Ai Chi with dry gym exercises on balance. This randomized clinical trial had a relative small total sample size (n = 17), but was nicely designed and could easily be repeated.. Balance was measured with the Berg Balance Scale. The Halliwick / Ai Chi group showed significant improvements in comparison with the dry gym group. The author concluded that Halliwick with Ai Chi may be effective in promoting balance and weight-bearing ability on people with stroke.

Another Korean physical therapist, Nam Cheung-Hong compared Halliwick and NDT in a RCT,[25] including 27 chronic stroke patients. He used various tests, amongst which also the Berg Balance Scale. Both groups showed a balance increase just above the smallest detectable difference, but he could not find inter-group differences after the intervention period of 6 weeks. At the start, these patients already showed an average score of 49 (out of maximum 54), so a ceiling effect cannot be excluded.

The role of the Halliwick method in patients with disabilities reported by qualified physiotherapists practising in the United Kingdom was the theme of a survey, done by Karolina Pilarczyk in 2006.[26] Results were extracted from questionnaires and interviews. Cerebral palsy

was the most often treated condition among all paediatric cases. Conclusion: Physiotherapists included in the study (n = 25) report that the Halliwick method is a helpful tool in the process of rehabilitation. However, they are using a combination of Halliwick with the other methods. Self-confidence and water skills were issues which physiotherapists selected as the most effective.

Getz[6] did a dissertation, called: Aquatic Intervention in Children with Neuro-Motor Impairments. She addressed the influence of aquatic interventions (Halliwick) on motor performance in a functional context on land. Emphasis should be placed on water orientation skills like breath control, walking across the pool, entering, exiting and other skills that ensure habituation to water. These skills represent daily activities in a different environmental context (according to the ICF and the dynamic systems model of motor learning). The aquatic intervention resulted in an increase in cardiovascular endurance and mobility skills performed on land as demonstrated in the PEDI (Pediatric Evaluation of Disability Inventory) mobility domain.[6, 7] There were satisfying correlations between the PEDI /GMFM (Gross Motor Function Measurement) and the AIM water orientation test, more recently also shown for the WOTA. This means that a relation exists indeed between certain domains of motor development in water and on land. Getz also found that the advantages of Halliwick especially showed up in the more severely disabled children (GMFMCS 5).

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## ADDITIONAL RESOURCES

- Obstacle course: www.ewac.nl
- The Halliwick Concept: www.halliwick.eu
- Videos on pool entries and exits: www.halliwick.org.uk

## REVIEW QUESTIONS

1. Which sequence of the Ten-Point-Programme can be used best when Halliwick is used in falls prevention:
   a. Breath Control – Transversal Rotation Control – Upthrust – Combined Rotation Control – Sagittal Rotation Control – Balance in Stillness
   b. Breath Control – Longitudinal Rotation Control – Turbulent Gliding – Sagittal Rotation Control – Disengagement – Transversal Rotation Control
   c. Longitudinal Rotation Control – Combined Rotation Control – Sagittal Rotation Control – Transversal Rotation Control – Balance in Stillness – Turbulent Gliding
   d. Breath Control – Balance in Stillness – Upthrust –Transversal Rotation Control – Sagittal Rotation Control – Longitudinal Rotation Control

2. What is the main theme in point 2: Sagittal Rotation Control:
   a. rotational control in the sagittal plane
   b. rotational control around the sagittal axis
   c. weight transfer
   d. moving sideways in a supine position

3. Breath control during mental adjustment is exercised by:
   a. frequent and strong exhalations
   b. abdominal and thoracic co-contraction
   c. techniques from Negative Pressure Breathing
   d. a combination of nasal and oral breathing

4. The literature about Halliwick and balance mainly shows that
   a. proprioceptive integration increases
   b. buoyancy positively influences muscle tension
   c. fall risk decreases through aquatic therapy
   d. Halliwick, like T'Ai Chi, increases postural stability

5. Balance strategies
   a. are always included when performing Halliwick
   b. will be changed mainly in the reactive area when doing Halliwick
   c. are different in water than on land
   d. can not be carried over from water to land at all

6. Facilitation of head balance for dystonic children takes place in Halliwick through:
   a. manual support of the head
   b. the experience in supine that ears are under water
   c. blowing exercises in combination with symmetrical supports
   d. using survival reflexes in prone

7. Children with Spina Bifida will mainly have problems with:
   a. floating
   b. lateral rotation control
   c. sagittal turning
   d. transversal rotation control

8. Metacentric effects are related to:
   a. moving a body part over the water surface from one position to another one
   b. bringing a body part into the water
   c. taking a body part out of the water
   d. all alternatives are correct

9. A stroke patient with a classical flexion pattern of the arm will roll, in general, towards the affected side when being in supine because:
   a. spasticity changes the density of the affected side
   b. the arm cannot be used to provide increase of radius
   c. the patient does not perceive the water surface
   d. trunk shortening changes the relative position of the lungs

10. In which situation, weight-bearing increases most? When the patient
   a. increases velocity and walks towards the shallow end of the pool
   b. increases velocity and walks towards the deep end of the pool
   c. decreases velocity and walks towards the shallow end of the pool
   d. decreases velocity and walks towards the deep end of the pool